Effect of water circulation and machine parameters on dust production and tissue processing

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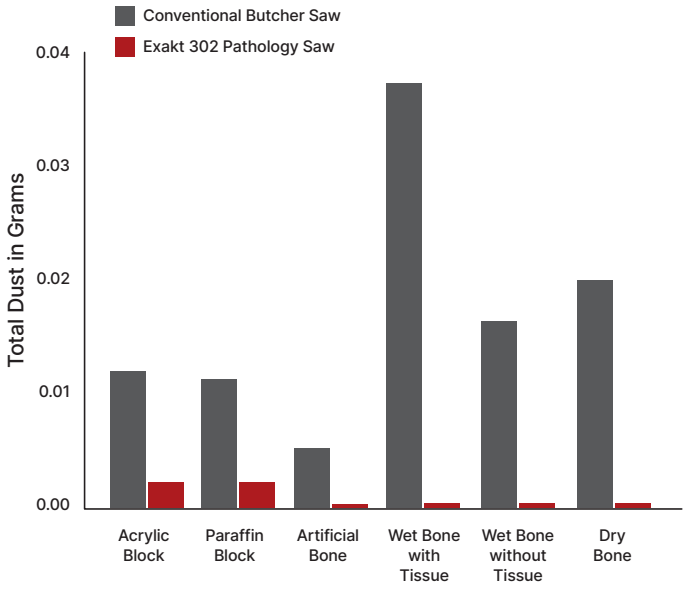
INTRODUCTION:

Pathology band saw is commonly used in histopathology laboratories for cutting hard tissue (dry bone, wet bone, engineered bone, bone with tissue), soft tissue (cartilage, tendon), implants (titanium, steel, cobalt-chrome), tissue embedding medium (methyl methacrylate (MMA) and paraffin). Containment of dust during cutting of any of the above samples is an environment and health safety issue. The goal of this project is to measure dust formation and tissue loss from water circulated pathology and non-water circulated butcher saw machines.

METHODS:

This study examined dust produced from six different samples commonly used in pathology lab: histology embedding medium (acrylic and paraffin), artificial bone (Sawbones tibia bone), and cadaveric goat tissue (wet bone with tissue, wet bone, and dry bone). Dust collection from cutting each sample was performed in a custom-made dust containment chamber (Figure 1). A vacuum system collected dust from the containment chamber and cutting surface. The accumulated dust weight was measured using a precision scale. Five samples were used (Figure 2) and cut from the same sample piece using water circulated (EXAKT 302 pathology saw) and non-water circulated butcher saw (Savioli band Saw) to get a statistically significant

FIGURE 1:



comparison. The vacuum system was equipped with a 3D printed suction cup to collect dust during the vacuum. The cup weight before and after the collection was measured to find a breathable dust amount. Each sample cutting surface area was measured using Nikon BR image processing software. Sample cutting volume from the saw machines was measured by multiply the cutting surface area and blade thickness.

RESULTS AND DISCUSSION:

We have observed a statistically significant difference between the collected dust amount from histology embedding mediumsamples between EXAKT 302 and Savioli general-purpose butcher saw (Figure 3). There was no dust produced when cutting the rest of the samples using EXAKT 302 saw machine, whereas we measured significant dust created from Savioli butcher saw. Table 1 reported that each sample cutting volume amount from EXAKT saw machine was significantly lower than the same produced from Samioli Saw machine. This result is due to the difference in blade thickness (EXAKT ~0.3 mm and Savioli ~0.635 mm) and the low vibration during cutting from EXAKT.

CONCLUSION:

The study observed that water circulation has a significant effect on the production of dust during cutting of the pathology sample. Also, we observed that cutting volume from the machine depends upon saw blade thickness, saw blade material, and vibration produced during sawing pathology samples. Considering the above factors, we concluded that EXAKT produced an insignificant amount of dust and less sample volume loss compared to general purchase butcher saw.

TABLE 1: Cutting Voume from the Saw Machine

Sample Type	Conventional (mm3)	Exakt 302 (mm3)
Acrylic block	232.48 ± 0.000	71.14 ± 1.77
Paraffin block	152.87 ± 5.33	111.43 ± 2.37
Artificial bone	223.36 ± 41.43	105.52 ± 19.57
Wet bone with tissue	216.82 ± 81.79	102.43 ± 38.64
Wet bone without tissue	145.76 ± 3.39	68.86 ± 1.61
Dry bone	133.56 ± 13.22	63.10 ± 6.24

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